

Comment on "Distribution of Partial Neutron Widths for Nuclei Close to a Maximum of the Neutron Strength Function"

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A recent Letter [1] attempted to reconcile the disagreement between neutron resonance data [2] and random matrix theory (RMT) [3]. To this end, a new formula was derived for transforming measured ($\Gamma_{\lambda n}$) to reduced ($\Gamma_{\lambda n}^0$) neutron widths for *s*-wave resonances ($\lambda = 1, 2, \dots$) in nuclides near peaks of the *s*-wave neutron strength function. In this Comment, we show that such a rescaling would not, in general, be expected to reconcile the type of disagreement observed, and demonstrate that indeed it does not for the specific cases in question. Hence, the disagreements between RMT and these data remain.

The rescaling, $\Gamma_{\lambda n}^0 = \Gamma_{\lambda n}/f^2(E_{\lambda n})$, where $E_{\lambda n}$ is the resonance energy, is supposed to remove the secular variation in $\Gamma_{\lambda n}$ with energy. The standard rescaling, $f^2(E_{\lambda n}) = \sqrt{E_{\lambda n}}$ was used in Ref. [2]. The new transformation derived in Ref. [1], $f^2(E_{\lambda n}) = \frac{1}{\pi} \left(\frac{2m}{\hbar} \right)^{1/2} \frac{\sqrt{E_{\lambda n}}}{E_{\lambda n} + |E_0|}$, has an extra factor $(E_{\lambda n} + |E_0|)^{-1}$ arising from the single-particle state (at energy E_0 relative to threshold) responsible for the peak in the *s*-wave neutron strength function.

RMT predicts that *s*-wave reduced neutron widths follow a Porter-Thomas distribution (PTD) [4]. The PTD is a χ^2 distribution with one degree of freedom ($\nu = 1$). In Ref. [2], the maximum-likelihood (ML) method was used to obtain $\nu_{ML} = 0.57^{+0.16}_{-0.15}$, $0.47^{+0.19}_{-0.18}$, and $0.60^{+0.28}_{-0.26}$, for ^{192,194,196}Pt respectively. Furthermore, it was shown that taken together the ^{192,194}Pt data reject the validity of the PTD with at least 99.997% confidence.

A smaller value of ν corresponds to a broader χ^2 distribution; hence, the ^{192,194,196}Pt data are broader than the PTD. It is easy to see that the extra factor proposed in Ref. [1] will, in general, result in a broader distribution compared to the standard transformation, except in the special circumstance when the average reduced width (calculated using the standard transformation) is (at least approximately) proportional to $(E_{\lambda n} + |E_0|)^{-1}$. Therefore, the transformation proposed in Ref. [1] would not, in general, be expected to reconcile the data of Ref. [2] with the PTD, but instead increase the disagreement. Nevertheless, we have repeated the ML analysis using the rescaling relation derived in Ref. [1]. The results are shown in Fig. 1, from which it can be seen that the new rescaling cannot reconcile the Pt data with the PTD.

According to Ref. [1], if the condition that $|E_0|$ is much

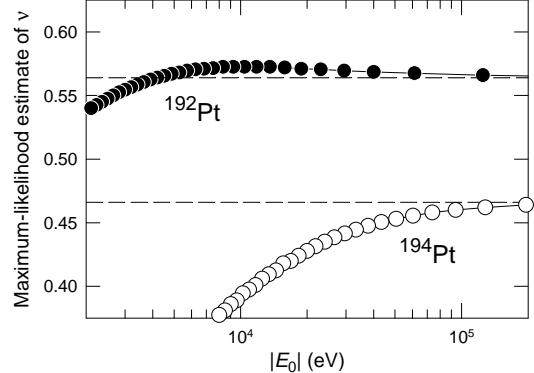


FIG. 1: ML estimates of ν from the sets of 153 and 161 widths $\Gamma_{\lambda n}^0$ for ¹⁹²Pt and ¹⁹⁴Pt, respectively, as functions of $|E_0|$. Dashed lines represent the ν_{ML} values reported in Ref. [2].

larger than the mean resonance spacing ($D_0 = 23, 50$, and 153 eV for ^{192,194,196}Pt resonances, respectively) fails, it is not justified to consider reduced neutron widths as energy-independent constants, and *R*-matrix theory cannot be used. As far as we know, the necessary alternative multi-level, multi-channel theory has not been developed, so we cannot address this scenario. However, it seems very unlikely that E_0 could be this close to threshold for all three Pt isotopes.

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